Botanical Nomenclature as adopted at Paris in 1954: (Article 63) "A name must be rejected . . . if it is a source of error"[1] and (Article 65) "A name must be rejected if it is used in different senses and so has become a long-persistent source of error." It seems to me that no purpose would be served by trying to retain a name which apparently can never be clarified with satisfaction. However, in view of the fact that monographic studies in *Lepanthes* will shortly be initiated, I merely offer this as a suggestion and leave formal action to the monographer.

CHROMOSOME NUMBERS IN THE GENUS KRAMERIA: EVIDENCE FOR FAMILIAL STATUS

B. L. Turner

The genus *Krameria* is composed of about 20 species of perennial herbs and shrubs, most of which occupy the warmer desert or semi-desert regions of North and South America (Britton, 1930). Since its initial description in 1762 the genus has been a taxonomic "problem", both as to rank and phyletic position. Some workers have recognized it as the single genus of the family *Krameriaceae* (Chodat, 1890; Small, 1903; Britton, 1930; Abrams, 1944; Cronquist, 1957; etc.); other workers have assigned the genus subfamilial rank within the *Leguminosae* (Benson and Darrow, 1954; Benson, 1957); while still others have relegated the group to merely tribal status within the subfamily *Caesalpinioideae* of the *Leguminosae* (Taubert, 1894; Capitaine, 1912; etc.).

Such differing taxonomic treatments are not particularly disturbing since most of the workers mentioned above are more or less in agreement that the relationship of *Krameria* lies within or close to the *Leguminosae* and in particular to the tribe *Caesalpinioideae*. However, there are serious doubts as to its phyletic position. It is interesting to note that while such an eminent worker as Taubert in Engler and Prantl's PFLANZENFAMILIEN treats the genus as a tribe within the subfamily *Caesalpinioideae* of the order Rosales, Hutchinson (1926) places the genus in the family *Polygalaceae* of the order *Polygalales*, quite removed from the *Leguminosae* proper. Indeed, Taubert had enough confidence

in his treatment to relate *Krameria* specifically to the tribes *Cassieae* and *Eucaesalpinieae* and so placed *Krameria* as tribe 6 between these two taxa. Hutchinson does not give reasons for the inclusion of *Krameria* in the *Polygalaceae*, but precedence for such a treatment may be found in Bentham and Hooker (1862) who also placed it in the *Polygalaceae*. The latter authors, in treating this family, listed *Krameria* last among a group of "genera affinis aut exclusa, v. dubia." Hallier (1912) also viewed the relationship of *Krameria* as being with the *Polygalaceae* but assigned it familial status.

Kunz (1913) has given the most detailed study of the problem to date. After a review of the literature and as a result of his own observations on exomorphic and anatomical characteristics he concluded that *Krameria* did not belong within the *Caesalpinioideae* but rather should be treated as a distinct family. He did not attempt to show phyletic position, but he did indicate that *Krameria* was perhaps closer to the *Leguminosae* than the *Polygalaceae*.

Since Kunz's excellent study only a few published facts have been added. Heimsch (1942), using anatomical criteria, considered the position of *Krameria* with respect to the *Leguminosae* and *Polygalaceae*. He concluded that *Krameria*, on the basis of wood structure, was closer to the latter family. However, Erdtman (1944), on the basis of pollen morphology, briefly commented on the unnatural position of *Krameria* when placed in the *Polygalaceae* and stated that it belonged to the *Caesalpinioideae* of the *Leguminosae*. Dr. John Dwyer (personal communication), after a broad study of floral types within the *Caesalpinioideae*, has concluded that *Krameria* does not belong within this subfamily, though he has no set opinion of its phyletic position.

In the present paper chromosome evidence has been used to evaluate the position of *Krameria* with respect to the *Caesalpinioideae*. Unfortunately, chromosomal information is not adequate to permit comparisons with the supposed extra-leguminous relatives of *Krameria*, so little can be added to the controversy regarding phyletic position.

K. grayi and *K. ramosissima* are small shrubs of semi-desert and desert regions of North America, while *K. lanceolata* is a widespread, common perennial herb which occurs throughout the

Chromosome Numbers

Meiotic chromosome counts[1] were obtained for three species of *Krameria* as enumerated below:

Species	*Source*	*n*
Krameria grayi Rose & Painter	TEXAS, Terrell Co.: 10 mi. east Sanderson. *B.L.T. 3927*	6
Krameria lanceolata Torr.	TEXAS, Coryell Co.: 3 mi. north Cooperas Cove. *B.L.T. 3811*	6
,, ,,	TEXAS, Kinney Co.: 12 mi. northeast Bracketville. *B.L.T. 3803*	6
,, ,,	TEXAS, Leon Co.: Marquez Dome. *M. C. Johnston et al. 54994*	6
,, ,,	TEXAS, Val Verde Co.: 10 mi. northwest Langtry. *B.L.T. 3771*	6
Krameria ramosissima (Gray) Wats.	TEXAS, Kinney Co.: 10 mi. southeast Bracketville. *B.L.T. 3874*	6

Southwestern United States and Mexico. All collections examined proved to be diploid with $n = 6$. Since the chromosomes in the first division of meiosis are exceptionally large, showing three or more chiasmata at metaphase (fig. 1), two-dimensional camera lucida drawings and photography become difficult.[2] Best counts are obtained from Division II of meiosis, when the chromosomes are less massive and thus flatten more easily. As indicated in figures 2 and 4, these chromosomes have nearly medium centromeres.

Discussion

Taubert in Engler and Prantl's PFLANZENFAMILIEN treated *Krameria* as the sole genus of the tribe *Kramerieae*, placing it after the tribe *Cassieae* of the *Caesalpinioideae*. By reference to floral morphology, Taubert (footnote, p. 166) explicitly reckoned its relationship to be with this latter tribe.

Since the inclusion of *Krameria* within the *Leguminosae* should depend upon the total similarities it shares with members of the *Caesalpinioideae*, it seems appropriate to examine the chromosomal evidence bearing on this presumed relationship. As indi-

[1] Buds were killed and fixed in a mixture of 4 chloroform: 3 absolute alcohol: 1 glacial acetic acid. Anthers were squashed in acetocarmine 3–14 days after collection. Voucher specimens are deposited in The University of Texas Herbarium, Austin, Texas.

[2] The meiotic chromosomes of *Krameria* rank among the largest known within the dicots. Covas and Schnack (1946) and Baldwin and Speese (1957) have documented somewhat larger meiotic chromosomes for two parasitic species of the Loranthaceae (*Psittacanthus cuneifolius* and *Phoradendron flavescens*). Except possibly for those of the well known species of *Paeonia*, these species have the largest meiotic chromosomes of any dicot known to the present writer.

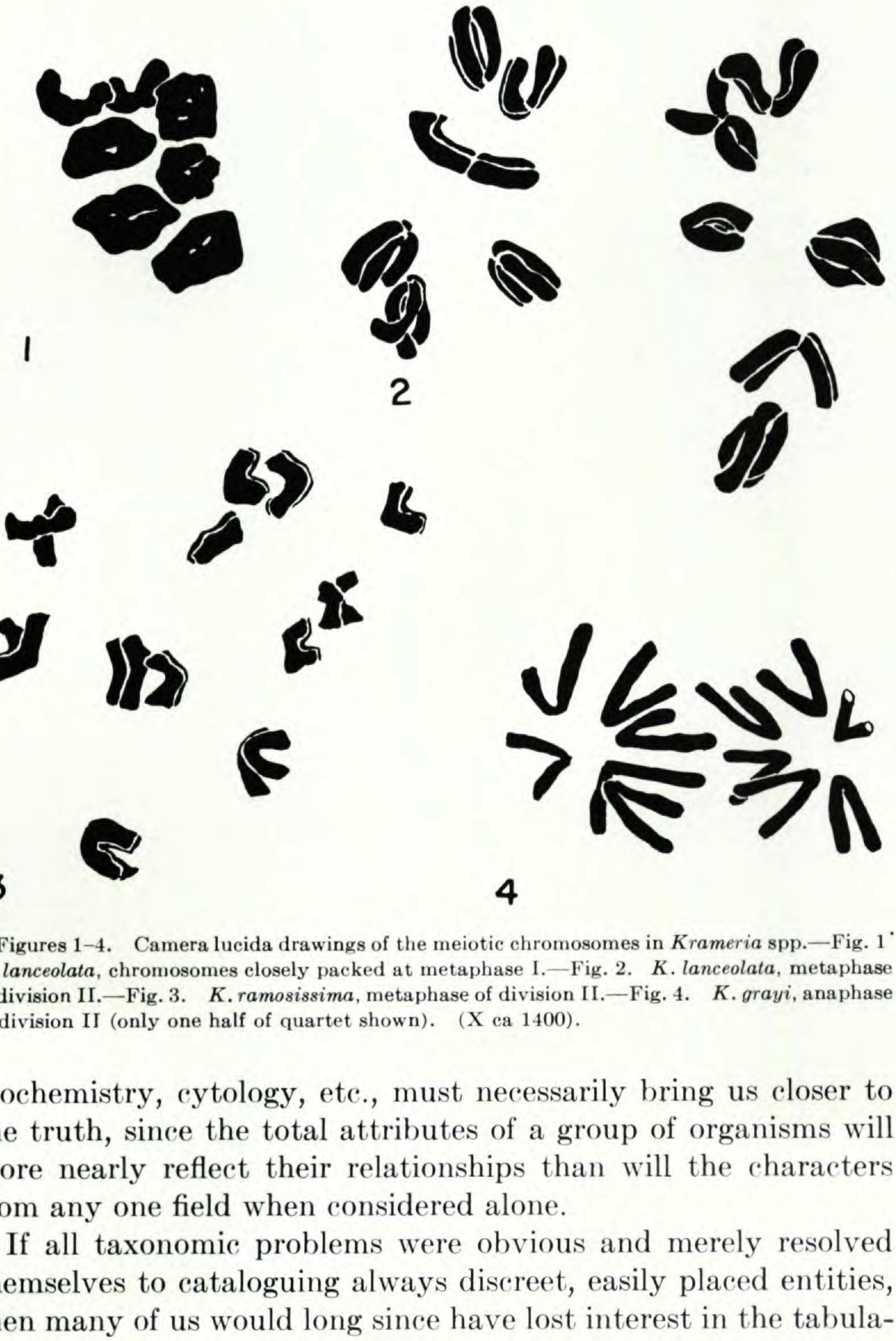
cated above, *Krameria* is, so far as known, unibasic with a number of $x = 6$, its meiotic chromosomes being especially noteworthy for their very large size and several chiasmata. A base number of $x = 6$ is not known for any of the tribes within the *Caesalpinioideae* (Darlington and Wylie, 1956).[3] However, since a base number of $x = 12$ is common for many genera of the *Caesalpinioideae* it might be conjectured that the number $x = 6$ for *Krameria* is but a lower base for the subfamily as a whole. Consideration of chromosome morphology proves more instructive. Meiotic chromosomes from a wide selection of *Cassia* species (Turner, 1956; H. S. Irwin, unpublished) are consistently small, usually showing only two terminalized chiasmata at metaphase. This is also true of the known meiotic chromosomes of species examined in the tribes *Bauhineae* and *Eucaesalpinieae*. By comparison, meiotic chromosomes of *Krameria* are 10–40 times as massive as those of the *Cassieae* thus far examined.

Unfortunately, *Krameria* can not be compared with the *Polygalaceae* since chromosomal information on the family is scanty. The only established base number for the family is $x = 7$ and this from a single *mitotic* count on *Bredemeyera colletioides* (Covas and Schnack, 1946).

Though the cytological evidence available at present does not permit one to judge phyletic alternatives, at least chromosomal comparisons of *Krameria* with members of the subfamily *Caesalpinioideae* seem to negate any close relationship with taxa of this group. In view of this negation, particularly as concerns its affinity with the *Cassieae*, the genus *Krameria*, even if related to the *Caesalpinioideae* on phyletic grounds, seems deserving of supra-tribal rank, if cytological evidence is considered along with that of wood anatomy, floral morphology, etc.

"Problem" taxa such as *Krameria* make present-day taxonomy the exciting field it is. One never knows how new evidence will affect the taxonomic scales. Indeed, it stimulates the taxonomist to look to other fields for additional weights that might affect the balance. Thus floral morphology, anatomy, palynology,

[3] These authors (p. 148) list 6 as one of several base numbers for *Cassia*, but this is not borne out by a reference to their listed counts. Senn (1938) gives a count of $n = 6$ for *Cercis canadensis*, but Baldwin (1939) reported counts of $2n = 14$ for several collections of the species. In view of the drawing accompanying Senn's report (p. 183), which appears to show two clumped chromosomes drawn as one, the report of $n = 6$ for this species should be considered erroneous.



Figures 1–4. Camera lucida drawings of the meiotic chromosomes in *Krameria* spp.—Fig. 1. *K. lanceolata*, chromosomes closely packed at metaphase I.—Fig. 2. *K. lanceolata*, metaphase of division II.—Fig. 3. *K. ramosissima*, metaphase of division II.—Fig. 4. *K. grayi*, anaphase of division II (only one half of quartet shown). (X ca 1400).

biochemistry, cytology, etc., must necessarily bring us closer to the truth, since the total attributes of a group of organisms will more nearly reflect their relationships than will the characters from any one field when considered alone.

If all taxonomic problems were obvious and merely resolved themselves to cataloguing always discreet, easily placed entities, then many of us would long since have lost interest in the tabulation and turned to other fields.

Literature Cited

Abrams, L. 1944. Krameriaceae. Illustrated flora of the Pacific states 2: 627–628.

Baldwin, J. T., Jr. 1939. Chromosomes from leaves. Science **90:** 240.

———, and B. M. Speese. 1957. *Phoradendron flavescens*: chromosomes, seedlings, and hosts. Amer. Jour. Bot. **44:** 136–140.

Benson, L. 1957. Plant Classification. 688 pp. D. C. Heath and Company, Boston.

Benson, L., and R. A. Darrow. 1954. The trees and shrubs of the Southwestern deserts. 437 pp. University of Arizona Press, Tucson.

Bentham, G., and J. D. Hooker. 1862. Polygalaceae. Genera Plantarum **1:** 134–140.

Britton, N. L. 1930. Krameriaceae. North Amer. Flora **23:** 195–200.

Capitaine, L. 1912. Étude analytique and phytogéographique du groupe des Légumineuses. 496 pp. Paris.

Chodat, R. 1890. (without title). Archives des Sciences Physiques et Naturelles Ser. 3. **24:** 495–499.

Covas, G., and B. Schnack. 1946. Numero de cromosomas en antofitas de la region du Cuyo (Republica Argentina). Rev. Arg. Agron. **13:** 153–166.

Cronquist, A. 1957. Outline of a new system of families and orders of dicotyledons. Bull. Jard. Bot. de l'État Bruxelles **27:** 13–40.

Darlington, C. D., and A. P. Wylie. 1956. Chromosome atlas of flowering plants. 519 pp. Macmillan Company, New York.

Erdtman, G. 1944. The systematic position of the genus *Diclidanthera*. Bot. Notiser **1944:** 80–84.

Hallier, H. 1912. L'origine et le système phylétique des angiospermes. Arch. Néerl. Sci. Exact. Nat. Ser. III B, **1:** 146–234.

Heimsch, C. 1942. Comparative anatomy of the secondary xylem in the "Gruniales" and "Terebinthales". Lilloa **8:** 83–198.

Hutchinson, J. 1926. The families of flowering plants. I. Dicotyledons. 328 pp. London.

Kunz, M. 1913. Die systematische Stellung der Gattung *Krameria* unter besonderer Berücksichtigung der Anatomie. Beihefte Botanisches Centralblatt **30:** 412–417.

Senn, H. A. 1938. Chromosome number relationships in the Leguminosae. Bibliographia Genetica **12:** 175–337.

Small, J. K. 1903. Flora of the Southeastern United States. New York.

Taubert, P. 1894. Leguminosae. In Engler and Prantl, Die Natürlichen Pflanzenfamilien III^3: 70–396.

Turner, B. L. 1956. Chromosome numbers in the Leguminosae. I. Amer. Jour. Bot. **43:** 577–581.